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DRAWINGS ATTACHED

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Rack-and-pinion steering.

COMPLETE SPECIFICATION

We, NSU MOTORENWERKE AKTIENGESELLSCHAFT, a German Company of Neckarsulm/Wurttemberg, Germany, do hereby declare the invention for which we pray that a Patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement.

The invention relates to rack-and-pinion steering for vehicles in which the rack and the pinion engage each other within a housing and in which the pinion is mounted eccentrically in a cylindrical bush which is inserted in the housing in a manner which allows it to rotate and the pinion is adjustable with respect to the rack by rotation of the bush.

The aim of the invention is to construct a rack-and-pinion steering assembly of the kind described above such that the play between the pinion and the rack is adjustable in as simple a manner as possible and that the steering functions as far as possible without any maintenance despite the wear that arises in use between the pinion and the rack. In one known solution in which a resilient mounting is provided for the pinion or the bush, this is achieved in that this resilient mounting receives a certain amount of pre-loading on play-free adjustment of the pinion with respect to the rack and the play that arises through wear is eliminated by resilience of the bearing material. In this solution, in order to make the steering light, the steering assembly must be adjusted relatively accurately and furthermore it must be regularly serviced as the range of adjustment of the resilient bearing is so small.

These drawbacks are overcome by the rack-and-pinion steering according to the invention which is characterised in that, for adjustment of the pinion with respect to the rack, there is provided a loading device which effects automatic rotation of the bush in one direction and a set-screw serving as

a stop to lock the bush against reverse rotation, and that flattened portions are provided on the periphery of the bush as engagement surfaces for the loading device and the set-screw.

The loading device comprises a hollow screw, preferably locked with respect to the steering housing, and a spring which is disposed in the hollow screw and which engages a pressure member that is guided in the hollow screw and engages the bush. A self-locking screw could be used, for example as the set-screw. The set-screw and the loading device could, however, also be combined in a single unit, the hollow screw having a shaft of appropriate length. A stop to prevent reverse rotation of the bush is necessary for safety reasons in order to prevent the pinion and rack coming out of engagement in all cases in which the separating forces arising between the rack and the pinion are greater than the engaging force of the spring disposed in the loading device.

In order to exclude the possibility of failure of the steering even in the event of incorrect assembly or on loss of the loading device and set-screw, a further safety feature is provided in the steering housing. In the construction according to the invention in which the bush has on its one end a flange engaging the steering housing, this comprises the feature that a peg is inserted in that wall of the steering housing that engages the flange of the bush and this peg engages in a groove in the flange of the bush which, starting from the point which corresponds to the position of the peg relative to the bush when the assembly is adjusted for substantially no play between the pinion and the rack, extends in the flange opposite to the direction of adjustment.

The position of the set-screw and the loading device on the housing can be chosen at will and can be designed to suit the space available. However, it should be borne in

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mind that especially the adjusting device works better, the greater is its effective lever arm.

The invention is described in detail in conjunction with the drawings, in which:

Figure 1 is an assembly drawing of the steering, partially in section;

Figure 2 is a section through the steering housing on the line 2—2 in Figure 1; and

Figure 3 is a section on the line 3—3 in Figure 2, i.e. is a detailed illustration of the steering housing according to Figure 1.

In Figure 1 there is shown a rack-and-pinion steering gear in which the rack 1 and the pinion 2 come into engagement within a steering housing 3. The rack 1 is mounted in bearings near its two ends in the housing 3 and in a tube 5 which is rigidly connected to the housing 3 and it carries on its ends the track rods 6 and 7. The pinion 2 that engages the rack 1 is eccentrically mounted in a bush 8 which is rotatably mounted in the steering housing 3 and the pinion is adjustable with respect to the rack 1 by rotating the bush 8.

Rotation of the bush 8 is performed by a loading device 10. As shown in Figures 2 and 3, this is formed by a hollow screw 11 which is locked with respect to the housing 3, a spring 12 and a pressure member 13 that engages the bush 8, for which the bush 8 has in its periphery a flattened portion 14 serving as an engaging surface.

The spring 12 and the pressure member 13 are guided in the hollow screw 11 and the loading of the spring 12 is adjustable by altering the depth of screwing-in of the hollow screw 11. The spring-loading is designed so that on the one hand despite the follow-up adjustment which is required during the course of wear, there is always reliable engagement of the pinion 2 against the rack 1 and that on the other hand lightness of steering is maintained. In order to avoid the rack 1 and the pinion 2 coming out of engagement even in those circumstances in which because of extreme loading the disengaging forces arising between the pinion 2 and the rack 1 are greater than the loading forces of the spring 12, there is disposed in the housing 3 a set-screw 9 which serves as a stop for the bush 8. The bush 8 also has a flattened portion 14 to serve as an engaging surface for the set-screw 9.

The possibility of making the loading device 10 and the set-screw 9 in one unit is not illustrated in the drawings but in such a construction the function of the set-screw 9 is taken over by the shank 15 of the hollow screw 11 which is extended as compared with the embodiment shown in Figure 2 and so can serve as a stop. In this construction the spring-loading can no longer be controlled by adjusting the depth to which the hollow screw 11 is screwed in and accord-

ingly there is screwed into the head of the hollow screw 11 a further screw serving solely for adjusting the spring-loading.

In order to exclude the possibility of failure of the steering even on incorrect assembly or on loss of the loading device 10 and the set-screw 9, there is, as shown in Figure 2, a peg 16 provided in the housing 3 and engaging in the groove 17 in the flange 19 of the bush 8. The groove 17 is arranged so that, starting from the point corresponding to the position of the peg 16 when there is substantially no play between the pinion 2 and the rack 1, it extends opposite to the direction of rotation of the bush 8 in the sense of adjustment of the pinion 2 towards the rack 1.

Figure 2 also shows the mounting of the bush 8 and the pinion 2. This could be done by needle-roller bearings, roller bearings or synthetic resin bearings and it should be noted that if synthetic resin bearings are used, any resilience that may be present is insignificant from the point of view of eliminating play between the rack 1 and the pinion 2, in contrast to the known construction.

The connection of the steering column 20 to the pinion 2 must be resilient to allow for the eccentric mounting of the pinion 2 and for this purpose a resilient disc 23 is inserted between the flange 21 connected to the steering column 20 and the flange 22 secured to the pinion 2.

WHAT WE CLAIM IS:

1. Rack-and-pinion steering for vehicles in which the rack and the pinion engage each other within a steering housing and in which the pinion is mounted eccentrically in a cylindrical bush which is rotatable in the housing and the pinion is adjustable with respect to the rack by rotating the bush, characterised in that for adjusting the pinion with respect to the rack there is provided in the housing a loading device for effecting automatic rotation of the bush in one direction, stop means for preventing reverse rotation of the bush and on the periphery of the bush flattened portions to form engaging surfaces for the loading device and the stop means.

2. Rack-and-pinion steering according to Claim 1 wherein said stop means are formed by a set-screw.

3. Rack-and-pinion steering according to Claim 1 or Claim 2 characterised in that the loading device comprises a hollow screw and a spring disposed within the hollow screw the spring engages a pressure member which is guided in the hollow screw and acts against the bush.

4. Rack-and-pinion steering according to Claim 2 or Claim 3 characterised in that the set-screw and the loading device are com-

the direction of adjustment.
5. Rack-and-pinion steering according to
5 any of the preceding claims, in which the
bush has on one of its ends a flange engag-
ing against the housing, characterised in that
a peg is inserted in that wall of the housing
which engages the flange of the bush and
10 this peg engages in a groove in the flange of
the bush which, starting from the point
which corresponds to the position of the peg
with respect to the bush when there is sub-
stantially no play between the rack and the
15 pinion, extends in the flange opposite to

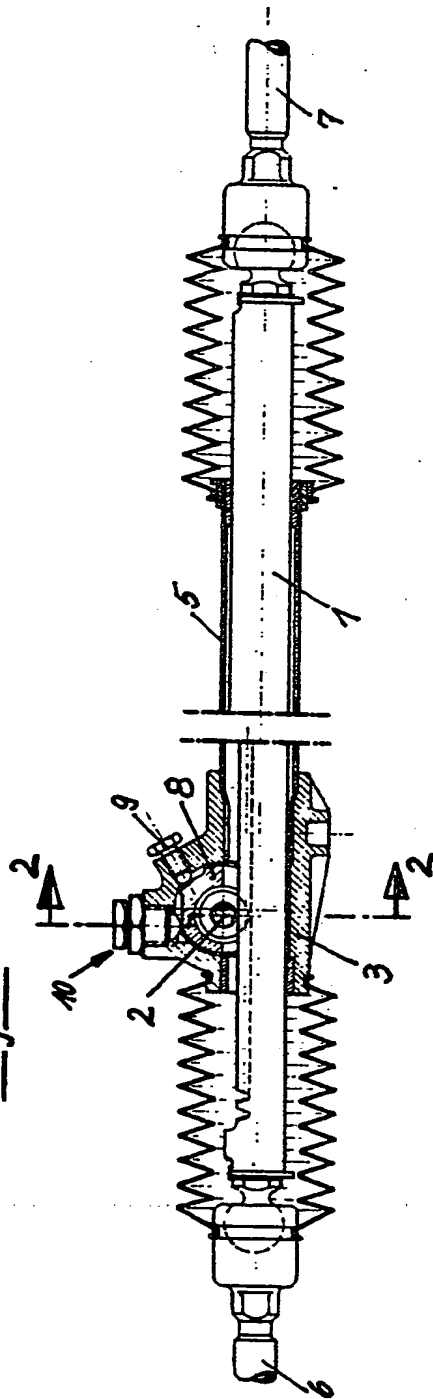
the direction of adjustment.
6. Rack-and-pinion steering for vehicles
substantially as described with reference to
and as illustrated in the accompanying
drawings.

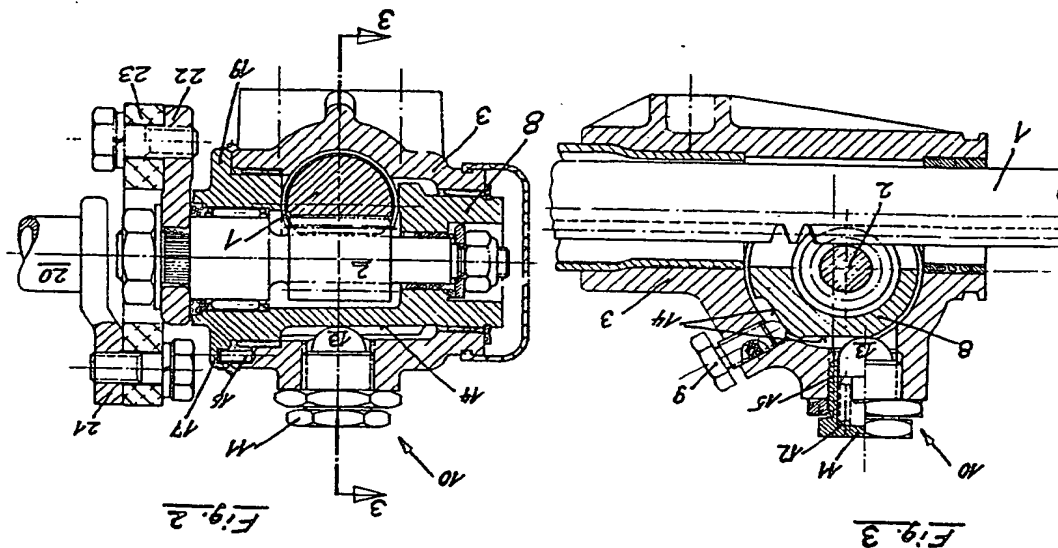
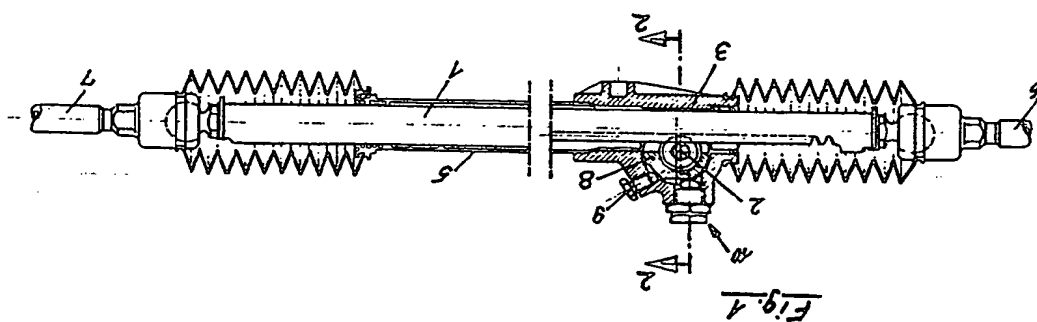
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Fig. 1





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